

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA**

STATE OF OKLAHOMA, ex rel.,

Plaintiffs,

vs.

TYSON FOODS, INC., et al,

Defendants.

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05-CV-0329 GKF-PJC

**DEFENDANTS' MOTION TO EXCLUDE THE TESTIMONY OF
DR. CHRISTOPHER TEAF AND INTEGRATED BRIEF IN SUPPORT**

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The undersigned Defendants respectfully move this Court to enter an order excluding the expert testimony of Dr. Christopher Teaf because it lacks reliability and relevance as required by Rule 702 and *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

I. INTRODUCTION

Dr. Teaf's opinions are inadmissible because they do not pass the reliability and relevancy tests set forth by the Supreme Court in *Daubert*. Dr. Teaf's Expert Report provides no reliable basis for his opinion that the land application of poultry litter can be causally linked to alleged risks to human health in the Illinois River Watershed ("IRW") from bacteria, disinfection byproducts ("DBPs"), water treatment facilities, or cyanobacteria. Dr. Teaf has not conducted any independent research in the IRW to prove that any levels of these constituents can be traced back to poultry litter and instead, he relies upon ultimate conclusions reached by several of the State's consultants – including the previously-excluded work of Dr. Harwood and Dr. Olsen – assuming the reliability of their work while candidly admitting that he does not know how they reached their conclusions.

Moreover, Dr. Teaf's opinions on alleged health risks in the IRW are belied by the State's sampling data; the county, state, and federal statistics for illness rates in the IRW; the absence of local, state, or federal regulatory warnings about recreating in waters in the IRW; and the weight of academic authorities and regulatory guidelines for assessing risk under the circumstances. Dr. Teaf admits that he had no prior experience or expertise in matters related to poultry litter prior to being hired by the State, and he considers himself to have become an expert on such matters during this case. Because such an approach evinces advocacy, not science, Dr. Teaf's testimony should be excluded.

II. STANDARDS FOR ADMISSIBILITY OF EXPERT TESTIMONY

In *Daubert*, the Supreme Court held that “under the [Federal Rules of Evidence] the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.” *Daubert*, 509 U.S. at 589. Once the proposed testimony of an expert is challenged on *Daubert* grounds, the proponent of the testimony “must show that the method employed by the expert in reaching the conclusion is scientifically sound and that the opinion is based on facts which satisfy Rule 702’s reliability requirements.” *Mitchell v. Gencorp Inc.*, 165 F.3d 778, 781 (10th Cir. 1999); see also *Ralston v. Smith & Nephew Richards, Inc.*, 275 F.3d 965, 970 n.4 (10th Cir. 2001) (the proponent of expert testimony bears the burden of proving that the testimony of their expert witnesses is admissible pursuant to Rule 702 and *Daubert*). Opinion evidence connected to existing data only by the *ipse dixit* testimony of the expert is not allowed. See *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997) (“A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered”).

III. ARGUMENT AND AUTHORITIES

In the following discussion, Defendants will demonstrate that Dr. Teaf’s testimony should be excluded because: (1) Dr. Teaf is not qualified to offer his stated opinions in this case as he admits that any expertise he may claim on poultry issues was acquired as part of this litigation, not by means of independent scientific investigation; and (2) Dr. Teaf has no direct or indirect evidence to support his opinions that the land application of poultry litter is creating alleged risks to human health from bacteria, DBPs, and cyanobacteria and instead, Dr. Teaf’s opinions are premised upon admitted assumptions and *ipse dixit* reasoning which necessitate a finding that his testimony is unreliable.

A. DR. TEAF IS NOT QUALIFIED TO OFFER HIS STATED OPINIONS IN THIS CASE.

As a general matter, Dr. Teaf claims to be a “toxicologist and a risk assessment specialist.” *See* Exh. 1 at 14:21-23. However, Dr. Teaf has never written a peer-reviewed article on *Salmonella*, *Campylobacter*, *E. coli*, bacteria in poultry or poultry litter, antibiotics, antibiotic resistance, indicator bacteria, or cyanobacteria. *See* Exh. 2 at 164:9-165:19; 166:18-22; and 168:22-169:5. Dr. Teaf has never testified in court or a deposition regarding: bacteria generally; the specific bacteria *Salmonella*, *Campylobacter*, or *E. coli*; the effect or impact of bacteria in surface water or groundwater; bacteria in poultry or poultry litter; impacts of nutrients on eutrophication; antibiotics; antibiotic resistance; cyanobacteria; indicator bacteria; or disinfection byproducts of waste treatment facilities. *See* Exh. 2 at 174:20-176:12. Dr. Teaf does not have expertise in “modeling of movement of waterbodies” with respect to “projected concentrations or activity levels of bacteria” and he does not have any prior experience in identifying risks from waterborne microbiological diseases when the source of the microbiological agent is unknown. *See* Exh. 1 at 14:24-60:8 and 19:7-21. Dr. Teaf has no professional experience regarding “microbiological issues” associated with “the application of biosolids to soil.” *Id.* at 25:11-18.

In sum, before he was hired by the State, Dr. Teaf had no prior experience in the specific issues central to this case and which are the subjects of his testimony alleging human health risks. Despite these limitations in his professional experience and training, Dr. Teaf considers himself to be “an expert on the topic of bacteria in poultry or poultry litter” as “a result of [his] activities in this case....” Exh. 2 at 180:1-7 (emphasis added). Dr. Teaf is, therefore, the quintessential “litigation expert,” or one who develops his opinions and alleged expertise for the courtroom – as opposed to a laboratory. Whether a theory was developed independent of litigation is an important *Daubert* consideration. *See Norris v. Baxter Healthcare Corp.*, 397

F.3d 878, 886 (10th Cir. 2005). Scientific theories generated solely for the purpose of litigation are suspect because “a scientist’s normal workplace is the lab or the field, not the courtroom or the lawyer’s office.” *Daubert v. Merrell Dow Pharm., Inc.*, 43 F.3d 1311, 1317-18 (9th Cir. 1995). Indeed, hired expert testimony can “turn [] scientific analysis on its head[,] ...reason[ing] from an end result in order to hypothesize what needed to be known but what was not.” *Mitchell v. Gencorp, Inc.*, 165 F.3d 778, 783 (10th Cir. 1999). The *Daubert* standards for admissibility of expert evidence do not permit one to become an expert on scientific matters under the tutelage of attorneys paying for one’s services as part of litigation. *See Daubert*, 43 F.3d at 1317-18. Therefore, the Court should reject Dr. Teaf’s testimony because he is unqualified to render his stated opinions in the case as any expertise he claims for matters related to poultry litter is “litigation expertise,” not scientific expertise.

B. DR. TEAF’S OPINIONS REGARDING AN ALLEGED RISK TO HUMAN HEALTH FROM BACTERIA IN IRW WATERS SHOULD BE EXCLUDED UNDER *DAUBERT*.

Although he is specifically trained as a toxicologist, Dr. Teaf’s role in this case requires him to abandon the standard tenants of toxicology (*e.g.*, dose/response relationships) and instead, chart new territory as the State’s expert tasked with synthesizing disparate data sets and reaching ultimate conclusions regarding alleged risks to human health. He is, in effect, the State’s designated “clean-up” batter. Dr. Teaf claims to draw from “multiple lines of evidence” to conclude that: (1) a large portion of the IRW is contaminated with “elevated” levels of bacteria; (2) the magnitude and distribution of the bacterial contamination represent imminent and substantial endangerments to human health; and (3) these elevated levels of bacteria are “primarily attributable” to the land application of poultry litter as a fertilizer and soil amendment. *See* Exh. 3 at 35.

However, neither the data nor reliable scientific methodology support Dr. Teaf's opinions and instead, demonstrate that: (1) bacterial levels in the IRW are similar to several other watersheds in the State where poultry litter is not applied; (2) no state or federal agency has declared that the IRW waters present a imminent and substantial endangerment to human health or otherwise acted to prevent the public from recreating in the IRW waters as a result of bacterial levels claimed by Dr. Teaf; (3) Dr. Teaf's "multiple lines of evidence" do not support his conclusion that the bacterial levels in the IRW are caused by, or "primarily attributable" to, the land application of poultry litter. In sum, Dr. Teaf has no direct or indirect evidence to link bacterial levels in the IRW to poultry litter and without this necessary evidentiary link, Dr. Teaf has no reliable, scientific means of showing that poultry litter is creating a risk of harm in IRW waterways. *See, e.g., State v. Tyson Foods, Inc.*, No. 08-5154, slip op. at 12 (10th Cir. May 13, 2009); *General Electric Co. v. Joiner*, 522 U.S. 136, 147 (1997) (expert testimony is unreliable if there is too great an analytical gap between the data and the opinion offered).

1. Dr. Teaf's opinions regarding an alleged risk to human health from bacterial contamination fail to satisfy *Daubert's* "fit" requirement for admissible expert testimony.

A key element of the relevance inquiry is what courts have described as "fit," *i.e.*, "whether expert testimony proffered in the case is sufficiently tied to the facts of the case that it will aid the jury in resolving a factual dispute." *Daubert*, 509 U.S. at 591; *see also McKenzie v. Benton*, 388 F.3d 1342, 1351 (10th Cir. 2004). As demonstrated below, Dr. Teaf's proffered opinions do not satisfy the "fit" requirement of the *Daubert* analysis because Dr. Teaf's opinions are not only unsupported by the evidence, they are contradicted by it.

a. The State's sampling program failed to demonstrate risk from the presence of poultry-sourced pathogens in IRW waters.

Dr. Teaf's opinions regarding an alleged risk to human health overlook a fundamental fact: he does not have any evidence that poultry-sourced pathogens exist in IRW recreational waters at levels that are known to cause illness in humans. In preparation for this litigation, the State spent years conducting thousands of tests on dust, groundwater, litter, public water systems, sediment, soil, spring water, and surface water looking for bacteria Dr. Teaf considers to be "poultry pathogens" – *i.e.*, *Salmonella*, *Campylobacter*, and *Staphylococcus*. Exh. 2. at 18:17-19:8. However, as this Court noted in denying the preliminary injunction Plaintiffs requested, there are numerous other sources of the bacteria that are the subject of Dr. Teaf's testimony. *State v. Tyson Foods, Inc., et al.*, No. 05-CV-329-GKF-SAJ, 2008 WL 4453098, at * 1, * 3 (N.D. Okla. Sept. 29, 2008). Moreover, the State's sampling failed to find these bacteria with any significant frequency, or in any significant quantities. Exh. 4 at 1444:15-1445:8, 1832:15-20.

First, with respect to *Salmonella*, approximately 823/853 – or 96% - of the State's samples (of all media, including poultry litter, water, and soil) were negative or below the detection limit for the bacteria. Importantly, only 2 of 17 samples of poultry litter were above the detection limit for *Salmonella*, which severely undercuts Dr. Teaf's hypothesis that poultry litter is the source of *Salmonella* that may be found in other environmental media within the IRW. *See* Exh 7-A. Second, the State sampled for *Campylobacter* approximately 428 times (for all media, including poultry litter, water, and soil) and 387 (*i.e.*, 90%) of the samples were negative or below the detection limit for the bacteria. Despite these hundreds of samples, the State never found *Campylobacter* in groundwater, poultry litter, soil, or springwater, and only 2/302 (*i.e.*, 0.7%) of the State's surface water samples showed the presence of *Campylobacter*

above detection limits.¹ Exh. 1 at 214:1-3; Exh. 7-B. Third, the State sampled for *Staphylococcus* approximately 929 times and 796 (*i.e.*, 86%) of the samples were negative or below the detection limit for the bacteria. The State never found *Staphylococcus* in poultry litter, soil, or spring water, and only 1/77 (*i.e.*, 1%) of the State's groundwater samples showed the presence of *Staphylococcus* above detection limits. Exh. 7-C. Finally, the State never tested for *E. coli* 0157; never tested for *Giardia*; and never tested for *Cryptosporidium*. Exh. 1 at 197:19-199:2; 217:12-17; and 286:7. Therefore, based upon the State's own sampling evidence, Dr. Teaf's conclusions regarding risks from alleged poultry-sourced bacteria are unsupported and unreliable.

b. The presence of indicator bacteria does not demonstrate the presence of poultry-sourced pathogens in IRW waters.

For more than 100 years, U.S. public health personnel have relied extensively on an “indicator organism” approach for routine monitoring and screening of the microbiological quality of drinking water. *See* Exh. 8 at 1. “More specifically, these enteric bacterial indicator microorganisms (predominantly ‘coliforms’) are typically used to detect the possible presence of drinking water from human waste” and this protocol was later expanded to recreational waters. *Id.* at 1-2 (emphasis added). Dr. Teaf concedes (as he must) that indicator bacteria are not necessarily pathogenic and that they are, instead, an “indicator” that pathogens may be present.

¹ Importantly, these two “surface water” samples were of edge-of field samples which – as it sounds – means that the State's consultants collected samples of runoff from fields after storm events. The State appears to have sampled only fields where poultry litter was applied – not fields without poultry litter – so the record is devoid of any evidence which would allow Dr. Teaf to reliably testify whether these observed bacterial levels were caused by the application of poultry litter, whether they were caused by another source, or whether the bacterial levels represent background conditions in the IRW. Further, Dr. Teaf has no evidence that any runoff from these edge-of-field sample sites ever traveled to recreational waters of the IRW. Exh. 2 at 350:18-351:18.

Exh. A at 129:4-12. Fecal indicator bacteria are produced by all warm-blooded animals so their detection does not provide any information as to their source. Exh. 4 at 682:6-8; Exh. 5 at 14-15; Exh 6 at 155:11-156:5) Therefore, to determine the risk, if any, posed by water that tests positive for indicator bacteria, the National Academy of Sciences recommends that investigators expand their testing beyond the initial screening/routine monitoring phase to include expanded sampling and investigation designed to identify particular pathogens, contamination sources, and the transport and survival behavior of the pathogens. *See* Exh. 8 at 14.

Dr. Teaf has not conducted an investigation into the presence of any particular pathogen in the IRW, and the State's consultants failed to identify the presence of pathogens in the vast majority of samples from the IRW. As a result of the State's numerous failures to obtain direct evidence of pathogens in the IRW, Dr. Teaf points to the presence of indicator bacteria as indirect support for his assumption that poultry-sourced pathogens are in IRW waters. Therefore, based upon the evidence in the case, Dr. Teaf would, at most, be able to testify that, based upon the presence of indicator bacteria, there may be a risk that pathogens of unknown origin are in the waters of the IRW.

However, Dr. Teaf cannot reasonably opine any further about the cause or quantification of this potential risk because his opinions on the risk (if any) are further limited by the fact that: the State tested IRW waters for these hypothetical pathogens but did not find them; the hypothetical pathogens are of unknown origin; and the hypothetical pathogens have not been typed to determine their virulence, or whether they are even pathogenic to humans. To put it simply, the record only supports a finding of indicator bacteria in the IRW – no more, no less. This is hardly evidence to support the State's theory that the indicator bacteria are sourced from poultry litter as numerous other watersheds throughout the State have elevated levels of indicator

bacteria where poultry litter is not applied, and where cattle have been identified as the primary source of the bacterial levels. *See, e.g., Tyson Foods, Inc.*, 2008 WL 4453098, at *1, *3; *State v. Tyson Foods, Inc.*, No. 08-5154, slip op. at 14 (10th Cir. May 13, 2009) (“IRW bacteria levels appear not to differ from bacteria levels in other bodies of water throughout Oklahoma, even where poultry farming is less common.”).

In sum, Dr. Teaf’s opinions are not supported by the facts because although the presence of indicator bacteria “indicates” that pathogens may be present in the water, it certainly does not necessitate that conclusion, and the presence of indicator bacteria does not tell anyone anything about the source of the indicators or whether pathogens are present. *See, e.g., Exh. 8* at 173 (“Several studies have also found that some indicator bacteria can grow outside the human or animal intestinal system...further confounding the correlation between pathogens and indicators.”).

c. ***County Health Department statistics do not demonstrate the presence of poultry-sourced pathogens in the IRW waters.***

The counties in Oklahoma and Arkansas track the incidence of human illness, including the illnesses that Dr. Teaf opines will be caused by poultry litter. However, Dr. Teaf concedes that the County Health Reports only chronicle incidents of disease and do not provide any direct evidence of the source of the reported illnesses from *Salmonella* or *Campylobacter*. *Exh. 1* at 106:18-107:4. Specifically, Dr. Teaf admits that the County Health Reports do not provide evidence as to whether the reported cases of bacterial illness were foodborne or waterborne (*Exh. 2* at 150:24-151:7) and that they do not provide information as to whether the reported incidents had anything to do with contact with water in the IRW (*Exh. 1* at 163:13-164:15). In contrast to the absence of source information contained in the County incidence statistics, the CDC reports

that in the United States, 80 percent of all *Campylobacter* illness and 95% of all *Salmonella* illness are foodborne, not waterborne. *See* Exh.9 at 610.

Despite these facts, and despite the fact that: (1) the State has not conducted any epidemiological work to assess illness rates in the IRW; (2) Dr. Lawrence, an expert witness for the State, declared the County health statistics to be of “limited utility” for reaching any meaningful conclusion in the case as to whether there is a connection between illnesses and land application of poultry litter in the IRW (Exh. 10 at 83:14-24); (3) Dr. Michael Crutcher, the State Health Commissioner, did not find evidence of elevated enteric infections in the IRW (Exh. 11); and (4) ODEQ has never found that the land application of poultry litter may create an endangerment to human health (Exh. 12), Dr. Teaf insists that the incidents of bacterial illness reported in the County Health statistics form part of his “multiple lines of evidence” that the land application of poultry litter is causing bacterial contamination of IRW waters which, in turn, is creating a substantial and imminent risk to human health. Exh. 1 at 69:5-70:9. As demonstrated above, Dr. Teaf has no evidence to support this assumption.

2. Dr. Teaf’s opinions regarding an alleged risk to human health from bacterial contamination are derived from unreliable, unscientific methodologies.

The touchstone for *Daubert* reliability is whether the proposed expert testimony has a sound basis in science external to the lawsuit: “The adjective ‘scientific’ implies a grounding in the methods and procedures of science.” *Daubert*, 509 U.S. at 590. Dr. Teaf’s conclusion regarding an alleged risk to human health caused by the land application of poultry litter in the IRW is pure speculation—devoid of a verifiable, scientific basis. By his own admission, Dr. Teaf has not done the core work of a toxicologist—he has not calculated an exposure concentration for, or a dose received by, anyone alleged to have had contact with waters in the IRW. Dr. Teaf simply assumes that poultry litter is the cause of constituents in IRW water – constituents for

which the State has failed to demonstrate their presence by consistent, scientific sampling or source analysis such as fate-and-transport modeling. This is not science; this is advocacy.

a. Dr. Teaf's testimony is premised upon the unreliable and inadmissible testimony of Dr. Harwood and Dr. Olsen.

Despite the fact that this Court has already rejected the work of Dr. Harwood and Dr. Olsen as being unreliable, Dr. Teaf continues to rely upon the work of Dr. Harwood and Dr. Olsen to support his opinion that the indicator bacteria in the IRW can be traced to the land application of poultry litter. Exh. 2 at 97:16-98:5. Specifically, Dr. Teaf relies on Dr. Olsen's "bacterial fingerprinting" and Dr. Harwood's "biomarker" for concluding that the bacteria in the IRW are more likely to be related to chickens than cows. Exh. 1 at 221:15-20; 230-232. Without the conclusions of Dr. Harwood and Dr. Olsen, Dr. Teaf cannot independently establish a connection between the land application of poultry litter and the indicator bacteria the State found in the environment because: he does not have sufficient expertise in microbiology or chemistry to render such an opinion; he has not conducted any fate and transport study to establish an indirect link between the two occurrences; and he has no other empirical means of establishing any causal connection between the two occurrences.

The May 2008 Reports from Dr. Harwood and Dr. Olsen confirm that their testimony at trial will mirror the excluded opinions they offered at the Preliminary Injunction Hearing. *See* Exhs. 13 and 14. Since the Preliminary Injunction Hearing, the Journal of Applied Environmental Microbiology has twice rejected Dr. Harwood's and Dr. Olsen's "biomarker" work in this case, concluding that their work was "inadequate, and in some cases inappropriate, for a scientific journal." *See, e.g.,* Exhibit 7 to Doc. No. 2030. One of the peer reviewers rejecting Dr. Harwood's work in this case echoed the concerns of Defendants by finding that Dr. Harwood has no "convincing data that the biomarker is not normally found in, at least some, soil

and runoff without the presence of poultry litter” because Dr. Harwood “failed to test either unimpacted soil or runoff.” *Id.*

Dr. Teaf relies upon the work of Dr. Harwood and Dr. Olsen as support for his opinion that poultry litter is the source of bacterial levels in the IRW. Under *Daubert*, “any step that renders the [expert’s] analysis unreliable . . . renders the expert’s testimony inadmissible.” *Mitchell*, 165 F.3d at 782. Dr. Harwood’s and Dr. Olsen’s work has already been rejected as unreliable by this Court, that exclusion has been affirmed by the Tenth Circuit Court of Appeals, and Dr. Harwood’s and Dr. Olsen’s work has subsequently been rejected at least twice by a scientific journal. Specifically, a peer reviewer of Dr. Harwood’s work rejected her work because:

In any given water sample, fecal contamination from any number of sources may be present...Correlation of poultry marker with fecal indicators [] does not provide any evidence of human health risk. The relationship of fecal indicators with human health risk was developed at sites contaminated primarily with human waste...This relationship is not expected to be the same for water contaminated with feces from nonhuman sources.

See Exh. 2 to Doc. No. 2028.

Consequently, Dr. Teaf’s reliance upon Dr. Harwood and Dr. Olsen in an attempt to establish a causal connection between detected levels of indicator bacteria and poultry litter means that Dr. Teaf’s testimony is plagued by the deficiencies of the flawed work by Dr. Harwood and Dr. Olsen, and that Dr. Teaf’s testimony should be excluded in the same way Dr. Harwood’s and Dr. Olsen’s testimony has been excluded. See *J. B. Hunt Transport, Inc. v. General Motors Corp.*, 243 F.3d 441, 444 (8th cir. 2001) (excluding expert testimony that is “inextricably linked” to the excluded testimony of another expert).

b. Dr. Teaf’s analysis offends the most basic scientific principles of scientific inquiry and his claimed areas of expertise, by assuming the presence of bacteria for which the State could have conducted tests.

Dr. Teaf understands that the State tested for *Salmonella* and *Campylobacter* and that after certain test results were discarded for “protocol difficulties,” “[t]here were no other reported detections of those.” Exh. 1 at 129:13-130:23. Nonetheless, Dr. Teaf advocates that the State’s negative tests for *Salmonella* and *Campylobacter* are not proof that the bacteria were not present in the samples but instead, that the negative results are possible proof that the bacteria really did exist. *Id.* at 130:20-23. Essentially, Dr. Teaf plans to testify that although the State tested for *Salmonella* and *Campylobacter* hundreds and hundreds of times and did not find it, the jury should just assume that the bacteria were actually in those “negative” samples.² Dr. Teaf theorizes that the reason *Salmonella* and *Campylobacter* were not found in the State’s samples is because the bacteria entered a “viable, but non-culturable” (“VBNC”) state. Exh. 2 at 21:6-22:8. Some members of the scientific community have determined that this is not a correct concept and that a more accurate explanation is that most of the organisms are killed in an aqueous environment with recovery occurring only for the small number of living and culturable bacteria. Exh. 15 at 13 and Exh. 16. Moreover, the National Academy of Sciences concludes that even though human pathogens such as *Salmonella* and *Campylobacter* may exist in a VBNC state, it is unclear whether such “injured” bacteria are actually infectious to humans so it “is important to note that the environmental and public health significance of injured bacteria, especially those that are VBNC, remains controversial and uncertain.” *See* Exh. 8 at 132-33.

Moreover, just because bacteria may not be culturable by standard culture methods, does not mean that the bacteria is not culturable or detectable by other means. The State could have tested for the presence of *Salmonella* and/or *Campylobacter* by using any number of modified

² As noted above, the State found *Salmonella* and *Campylobacter* in a small number of samples. *See* Section III.B.1.a, *supra*. However, the vast majority of the State’s tests were negative. *Id.*

culture procedures or non-culture molecular methods. *See* Exh. 15 at 13-14; Exh. 6 at 56:20-57:6; Exh. 5 at 15-18. The State simply chose not to do these tests.³ Dr. Teaf plans to testify that “[we] went to the watershed. We didn’t find the bacteria there, but it was there. It was there in a state that wasn’t detectable.” Exh. 1 at 121:19-21. However, Dr. Teaf’s testimony on whether certain bacteria “wasn’t detectable” is unreliable because Dr. Teaf is not a microbiologist and because he is unaware of the multiple alternative testing methodologies available to detect bacteria under these circumstances. Exh. 2 at 21:6-22:8. Dr. Teaf’s testimony on an alleged risk from the assumed presence of VBNC bacteria is also unreliable because what Dr. Teaf does not know – and what is still uncertain in the scientific community – is whether the VBNC bacteria that Dr. Teaf assumes to have been present would ever have been able to infect any person. *See* Exh. 8 at 132.

When queried about the evidence he has that *Campylobacter*, *Salmonella*, or *E. coli* 0157 are actually in the surface waters of the IRW, Dr. Teaf candidly admits that his opinions regarding the presence of those bacteria are based on an “assumption” predicated upon the presence of indicator bacteria. Exh. 1 at 284:24-286:9 (emphasis added). Likewise, Dr. Teaf assumes the presence of *Giardia* and *Cryptosporidium* not based on any test finding that those bacteria are present, but solely upon the presence of other indicator bacteria of unknown origins. *Id.* at 197:19-199:2.

Dr. Teaf attempts to support his presumptions of risk by citing to EPA’s 1986 Water Quality Criteria for Recreational Waters, but he ignores subsequent EPA publications and other authorities cautioning that the 1986 EPA study assessed the risk to recreational waters that were

³ Notably, as detailed in Defendants’ motion to exclude Dr. Harwood’s testimony pursuant to Daubert, Northwind’s lab notebook shows that Dr. Harwood did actually test at least two litter

impacted by human, not animal sources of bacteria, and that the relationship of fecal indicator bacteria with human health risk is not expected to be the same for water contaminated with feces from animal sources. Exh 18. Dr. Teaf admits that, as a general matter, human feces poses a greater risk to humans than animal feces because virtually all enteric pathogens of humans are infectious to other humans while relatively fewer of the enteric pathogens of animals are infectious to humans. Exh. 2 at 109:10-110:4. The reason for this is “species specificity” which is a microbiological and infectious disease term describing the fact that organisms from humans are able to attach to the receptors in the human intestine and produce a human-specific inflammatory response or invade the human bowel wall. *See* Exh. 15 at 14-15 and Exh. 17 at 77. In contrast, many organisms of animal origin may not be able to infect a human host because they lack the proper receptors to attach to human intestines and thus, cannot produce a disease response. *Id.*

In addition to the non-scientific assumptions made by Dr. Teaf, and Dr. Teaf’s ignorance regarding readily available methods for detecting the presence of *Salmonella* and *Campylobacter* in water, Dr. Teaf’s stated testimony is inconsistent with the fundamental tenants of toxicology. Dr. Teaf has not established a dose or an exposure for anyone—real or hypothetical—recreating within the IRW. Therefore, even assuming that a toxicologist is qualified to opine on microbiological (as opposed to chemical) exposures, Dr. Teaf has failed to do what a toxicologist must do when determining whether a substance creates a risk of disease in anyone. As the federal courts have recognized, “the relationship between dose and effect (dose-response relationship) is the hallmark of basic toxicology. Dose is the single most important factor to consider in evaluating whether an alleged exposure caused a specific adverse effect.” *McClain v.*

samples for *Salmonella* using a more sensitive PCR-based tests but the results of the tests were

Metabolife Int'l, 401 F.3d 1233, 1242 (11th Cir. 2005). Therefore, if Dr. Teaf's testimony is offered based upon his expertise as a toxicologist, it should be excluded because "he does not follow the basic methodology that scientists use to determine causation – the dose-response relationship." *Id.*

Dr. Teaf's testimony as a self-proclaimed "risk assessment specialist" is likewise contrary to established practices within the field of risk assessment. The National Academy of Sciences and the U.S. Environmental Protection Agency ("USEPA") define a four-step process for risk assessment: (1) hazard identification; (2) dose-response estimation; (3) exposure assessment; and (4) risk characterization. Exh. 19 at 412-413; and EPA's Risk Assessment Portal: "How Does EPA Conduct a Human Health Risk Assessment?" located at <http://www.epa.gov/riskassessment/health-risk.htm> (Exh. 20). However, Dr. Teaf appears to have skipped from Step 1 to Step 4 without bothering to conduct the scientific inquiry and analysis required by Steps 2 and 3.

The first step, "hazard identification," is defined by the EPA as:

...the process of determining whether exposure to a stressor can cause an increase in the incidence of specific adverse health effects (e.g., cancer, birth defects) and whether the adverse health effect is likely to occur in humans. In the case of chemical stressors, the process examines the available scientific data for a given chemical (or group of chemicals) and develops a weight of evidence to characterize the link between the negative effects and the chemical agent.

<http://www.epa.gov/riskassessment/hazardous-identification.htm>. The Second Step, establishing a "dose-response relationship" requires a description of "how the likelihood and severity of adverse health effects (the responses) are related to the amount and condition of exposure to an agent (the dose provided)." <http://www.epa.gov/riskassessment/dose-response.htm>. EPA describes the Third Step, "exposure assessment," as"

negative. *See* Doc. No. 2030 at 24.

...the process of measuring or estimating the magnitude, frequency, and duration of human exposure to an agent in the environment, or estimating future exposures for an agent that has not yet been released. An exposure assessment includes some discussion of the size, nature, and types of human populations exposed to the agent, as well as discussion of the uncertainties in the above information. Exposure can be measured directly, but more commonly is estimated indirectly through consideration of measured concentrations in the environment, consideration of models of chemical transport and fate in the environment, and estimates of human intake over time.

<http://www.epa.gov/riskassessment/exposure.htm>. The Fourth Step, “Risk Characterization,” is defined by EPA as summarizing and integrating information from Steps 1-3 to synthesize an overall conclusion about risk. <http://www.epa.gov/riskassessment/risk-characterization.htm>.

Similar to the Step 1 process of conducting a “weight of the evidence” analysis, Dr. Teaf claims to have relied upon “multiple lines of evidence” to conclude that bacterial levels in the IRW pose a risk to human health. However, Dr. Teaf has not – and indeed cannot – complete Step 2 because the failures in the State’s sampling program prevent Dr. Teaf from having the data he would need to establish a dose-response relationship for any human pathogens in the IRW. Likewise, Dr. Teaf has not – and cannot – complete Step 3 because he has no direct evidence of exposure and, because the State has not conducted a fate and transport analysis, Dr. Teaf does not have an indirect means of establishing exposure. *See, e.g., State v. Tyson Foods, Inc.*, No. 08-5154, slip op. at 14 (10th Cir. May 13, 2009) (“Oklahoma failed to conduct a fate and transport study to establish that any surviving bacteria from poultry litter actually reached waters of the IRW.”); Exh. 4 at 301:21-302:10, 405:8-13, and 680:16-18, 688:24-699:17. Moreover, because Step 4 is defined as a synthesis of Steps 1-3 and because Dr. Teaf has not conducted Steps 2 or 3, Dr. Teaf could not have completed Step 4.

Dr. Teaf’s opinion that bacteria levels in the IRW pose an imminent and substantial risk to human health are not grounded in science because: he assumes the presence of pathogens for which scientists would test to determine their presence; he renders opinions about disease and

risk while ignoring the fundamental toxicological principle of dose-response; and he fails to follow the standard, established procedures for conducting a human health risk assessment. Therefore, Dr. Teaf's testimony should be excluded as nothing more than *ipse dixit* because courts have excluded expert testimony on causation where the expert's opinion omitted a determination of the level of exposure to that substance. *See, e.g., Mancuso v. Con. Edison Co. of New York*, 967 F.Supp. 1437 (S.D.N.Y. 1997) (expert's methodology of determining causation without a dose-response analysis was unreliable under *Daubert* because it ignored "the most fundamental tenet of toxicology - toxins cause illnesses only at sufficient dosages") and *Allen v. Pa. Eng'g Corp.*, 102 F.3d 194, 199 (5th Cir. 1996).

In fact, the Western District of Oklahoma excluded testimony from Dr. Teaf earlier this year under analogous circumstances. *See* Exh. 26. In that matter, Judge Cauthron permitted Dr. Teaf to testify on general types of health risks posed by substances "shown to be emitted" by the Defendant, but she excluded Dr. Teaf's proposed testimony on causation because Dr. Teaf:

...has not performed the necessary analysis to testify that Continental Carbon is the cause of Plaintiffs' symptoms. Dr. Teaf did not attempt to determine the degree of Plaintiffs' exposure, if any, to the substances emitted by Continental Carbon. As a result, he has no basis to conclude that Plaintiffs are experiencing any particular symptom based upon exposure to any particular chemical. Therefore, his testimony linking the plant's emissions to Plaintiffs' symptoms is unreliable and will be excluded.

Id. at 7. Much like the *Continental Carbon* case, the central issue in this case is one of causation – *i.e.*, whether the State can demonstrate a causal connection between: (1) the land application of poultry litter; and (2) the presence of poultry-sourced human pathogens in waters of the IRW at levels sufficient to create a risk to humans. Dr. Teaf does not have evidence of water-borne disease in the IRW from poultry-sourced pathogens, nor any evidence that anyone has been exposed to such pathogens. Therefore, like Judge Cauthron, this Court should exclude Dr.

Teaf's testimony on causation because Dr. Teaf has no basis to conclude that anyone is being subject to any risk as a result of the land application of poultry litter in the IRW. *Id.*

Dr. Teaf cannot rely upon the unreliable and inadmissible work of Dr. Harwood and Dr. Olsen, and the presence of indicator bacteria do not demonstrate the presence of any pathogen nor do they tell anyone anything about the source of the indicators. Because Dr. Teaf has no evidence regarding the source of the indicator bacteria found by the State, and because the State's sampling program failed to identify the presence of any poultry-sourced pathogens at levels or frequencies that would cause human illness, Dr. Teaf's potential testimony must necessarily be reduced to this: the State has detected the presence of indicator bacteria of unknown origin and these indicator bacteria do not, in and of themselves, demonstrate the presence of pathogens. Thus, Dr. Teaf has no evidence to support his testimony on causation.

The factually-unsupported, *ipse dixit* nature of Dr. Teaf's testimony on causation is perhaps most clearly demonstrated by the following excerpt from his July 30, 2008 deposition:

- Q. Dr. Teaf, are you seriously contending to this court and jury that the Adair County health statistics for Campylobacteriosis indicate a connection between the land application of chicken litter and people getting Campylobacteriosis?
- A. I don't think you can rule that out.
- Q. But are you making that contention?
- A. I believe that that's a **possibility**, and I believe it's consistent with what we know about the broad occurrence of Campylobacter in chickens. I have not made the link to any particular individual as you have pointed out, but I think that there is a consistent thread and a consistent line of logic here that would **imply** there's at least a component of the problem.
- Q. So then you are contending to this court and this jury that the Adair County Campylobacteriosis statistics show that there is a causal link between the land application of chicken litter and people getting Campylobacteriosis?
- A. No, that's not what I said. I phrased it in the way I did for a very specific reason. I believe that the link is there between Campylobacter and chickens and the application of that with exposure to human beings, the bacteria levels in the Illinois River in Adair County and **the possibility**

that this is related, but I don't believe that it's been ferreted out in sufficient detail. I don't think that makes it meaningless, however.

Exh. 2 at 129:15-130:18 (emphasis added). Therefore, Dr. Teaf admits that at the very most his testimony equates to nothing more than the **possibility** that there is a causal link between the land application of poultry litter and bacterial disease in the IRW – a possibility which, in Dr. Teaf's own words, has not been “ferreted out in sufficient detail” in this case. *Id.*

C. DR. TEAF'S OPINIONS REGARDING AN ALLEGED RISK TO HUMAN HEALTH FROM DISINFECTANT BYPRODUCTS AND CYANOBACTERIA SHOULD BE EXCLUDED UNDER *DAUBERT*.

In addition to the testimony discussed above regarding the assumed presence of bacteria from poultry litter and their alleged risk to humans, Dr. Teaf plans to testify that: (1) the land application of poultry litter has caused increases in nutrients such as phosphorus in the IRW; (2) these increased levels of nutrients have resulted in eutrophication and increased algal growth in the IRW, including Lake Tenkiller; (3) when drinking water systems treat raw water for human consumption, these increased levels of algae and other forms of waterborne organic carbon combine with the drinking water disinfection process to produce potentially dangerous Disinfection Byproducts (“DBPs”), such as trihalomethanes (“THMs”) and haloacetic acids (“HAA5s”); and (4) sampling results have identified levels of THMs and HAA5s in drinking water distribution systems that withdraw water from the IRW at levels that “represent an imminent and substantial endangerment to human health.” Exh. 3 at 35. However, Dr. Teaf's opinions should be excluded because they contradict the established science and regulatory standards governing the assessment of DBPs; rest upon insufficient data; and suffer from the numerous analytical errors discussed below.

1. Dr. Teaf's opinions on the sources of disinfectant byproducts and organic matter are based upon assumptions, not science.

In the same way that Dr Teaf mistakenly assumes that poultry litter is the source of indicator bacteria detected in IRW waters (while ignoring other known sources such as cattle, septic tanks, urban runoff, and water treatment facilities), he makes the mistake of assuming that all of the organic materials that allegedly contribute to the formation of DBPs come from runoff from fields where poultry litter has been applied, and ignores other important sources of organic carbon that include: natural organic matter from leaves, soil, and other naturally occurring organics, and the presence of DBP precursors discharged by waste water treatment plants into the waters of the IRW. Exh. 21 at 55. Dr. Teaf has no evidence that any organic material in the Illinois River or Lake Tenkiller came from poultry litter and not thousands of other sources of leaves, grass, algae, and other organic compounds available in the IRW. Therefore, Dr. Teaf's attempts to establish a causal connection between the spreading of poultry litter with high levels of DBPs in water treatment systems miles downstream (Exh. 3 at 24) must fail because Dr. Teaf has failed to demonstrate that any DBP precursors are linked to poultry litter and he has failed to identify any evidence that DBP violations occur to any greater extent in the IRW than in any other place in Oklahoma.

2. Dr. Teaf erroneously compared DBP data with MCLs, MCLGs, and Chloroform Risk-Based Screening Levels.

Dr. Teaf erroneously asserts that water utilities must comply with numbers, goals, and levels other than established MCLs. *See* Exh. 3 at 26; Exh. 2 at 393. Meeting MCLs is the foundation for compliance with primary drinking water regulations under the Safe Drinking Water Act whereas MCLGs are nonenforceable goals. *See* 40 C.F.R. Part 141.2. A key example of Dr. Teaf's misunderstanding or misapplication of the regulations applicable to water utilities is found in his discussion of chloroform where Dr. Teaf confuses and blurs important distinctions

between risk-based screening levels for chloroform at contaminated sites with chloroform concentrations for drinking water. Exh. 21 57-58.

3. Dr. Teaf errs in his comparison of trihalomethane formation potential and TTHM data.

Dr. Teaf fundamentally misstates the conclusions that may properly be drawn from trihalomethane forming potential (“THMFP”) values for certain samples collected as part of this litigation. Exh. 3 at 28; Exh. 2 at 380; Exh. 21 at 58. Essentially, Dr. Teaf improperly attempts to interpret THMFP values through the THMFP MCL regulatory values. In Dr. Teaf’s deposition, he testified that by determining the trihalomethane-forming potential for a raw water source sample, one may determine the “inherent ability of that water to form trihalomethanes upon a normal chlorination process.” Exh. 2 at 380. However, the analytical method by which THMFP values are determined does not represent a normal chlorination process. Exh. 21 at 58. Instead, the process for determining THMFP values involves large doses of chlorine designed to accelerate the production of THMs to give an indication of organic and inorganic precursor levels in the water. *Id.* THMFP measures the potential for a water sample to form THMs under extreme chlorination conditions in a laboratory environment, not the “normal chlorination process” associated with public water treatment facilities. *Id.* at 59.

4. Dr. Teaf’s opinions on Cyanobacteria are not based upon reliable evidence or scientific methodology.

Dr. Teaf opines that the land application of poultry litter as a fertilizer and soil amendment has resulted in an increase in nutrients in IRW waters which has, in turn, caused eutrophication and increased algal growth throughout the IRW, including Lake Tenkiller. Exh. 3 at 35. Dr. Teaf contends that one of the measures of increased eutrophication is the detection of “potentially dangerous levels of Cyanobacteria, also termed ‘Harmful Blue Green Algae.’” *Id.*

Cyanobacteria are organisms that share some characteristics with algae and bacteria, and some cyanobacteria produce toxins of which the most common are microcystins. Exh. 22 at 136.

Dr. Teaf claims that the State's testing of Lake Tenkiller during August 2004 through August 2007 showed that approximately 58% of all samples (233/404) exhibited cyanobacterial densities of greater than 20,000 cells/mL. Exh. 3 at 34. 55/404 of the samples (*i.e.*, 14%) were greater than 100,000 cells/mL, and one sample from June 2006 exceeded 1,000,000 cells/mL. *Id.* Dr. Teaf understands that World Health Organization ("WHO") guidelines "are widely used in the public health community to evaluate potential risks that may be posed by cyanobacteria in water supplies" and that they project only a low risk to health at densities less than 20,000 cells/mL of cyanobacteria, and only a moderate risk at levels at or above 100,000 cells/mL. *Id.* Moreover, the WHO guidelines only suggest a high probability of adverse health effects if there is scum formation in areas where whole-body contact or ingestion/aspiration could potentially occur. *Id.* So, even under Teaf's own statements and his own data, there is no evidence of "an imminent and substantial endangerment to human health" from cyanobacteria because Teaf does not cite evidence demonstrating the presence of visible cyanobacteria scum in recreational areas, and the reported levels for at least 403 of the 404 samples taken are at or below levels considered to be low or moderate risks to humans. Exh. 3 at 35 and Exh. 22 at 149-154.

The only empirical evidence of alleged taste and odor problems within the IRW appears to be a few, seemingly random phone calls made by the State's investigators to 20 utilities along the Illinois River and Lake Tenkiller. Exh. 3 at 32. Five of the twenty utilities had received complaints of taste and odor which, according to Teaf, "[p]otential explanations for these negative taste and odor complaints include cyanobacterial algal products." *Id.* However, Dr. Teaf made no effort to support this conclusion by reviewing actual data from these facilities or

connecting the dates and locations of these alleged taste and odor complaints to any samples or data. Further, neither Dr. Teaf nor anyone of the State's consultants has attempted to determine whether observed cyanobacteria levels were the result of known nutrient contributors such as insufficiently treated sewage, agricultural runoff, manure application, effluent from livestock industries, or runoff from roads in urban areas. Therefore, much like Dr. Teaf's defective analysis with respect to bacteria—where he assumed that poultry litter was the source without considering other known sources—Dr. Teaf again simply assumes that poultry litter is the source of nutrient levels or cyanobacteria growth in the IRW. Reliance on assumptions, in lieu of available testing, is not scientific so this Court should reject the opinions of Dr. Teaf on this issue.

Dr. Teaf's opinions regarding an alleged risk from cyanobacteria in the IRW are further discounted by the evidence. First, the State's samplers did not detect any microcystin in the samples collected from Lake Tenkiller. Exh. 23 at 32. Second, Dr. Teaf does not have any evidence that levels of cyanobacteria in the IRW are any greater than other waterbodies throughout the State. For example, the United States Geological Survey reported that the average cell count of cyanobacteria for one site at Fort Cobb Reservoir in Caddo County in western Oklahoma was greater than 200,000 cells/mL. Exh. 24 at 2-5, 17, and 69. Similarly, the Oklahoma Water Resources Board found that the algae in Lake Thunderbird was predominated by cyanobacteria and had an average cell density greater than 100,000 cells/mL for three different years (2001, 2002, and 2003) and almost 1,000,000 cells/mL in 2001. *Id.* Exh. 25. The Oklahoma State Department of Health Epidemiology Bulletins do not identify any outbreak with respect to cyanobacteria associated with non-treated recreational water. *See* Archives of the Oklahoma Department of Health Epidemiology Bulletins located at:

http://www.ok.gov/health/Disease_Prevention_Preparedness/Acute_Disease_Service/Publications_and_Statistics/index.html. Moreover, the CDC has not reported any outbreaks due to cyanobacteria in Oklahoma for the past ten years. See Archives of the CDC Morbidity and Mortality Weekly Reports at www.cdc.gov/mmwr/mmwrpv.html. Therefore, Dr. Teaf's opinions on alleged risks from cyanobacteria should be excluded because they are unsupported by the evidence and derived from unscientific, unreliable methodologies.

IV. CONCLUSION

Dr. Teaf has not conducted any independent research in the IRW to prove that any poultry-sourced constituents are creating a risk to human health. Instead, Dr. Teaf: (1) relies upon the ultimate conclusions reached by several of the State's experts, despite the fact that he admits he does not know how they reached their conclusions; (2) relies upon the previously-excluded work of Dr. Harwood and Dr. Olsen; (3) ignores the fact that the State's sampling program failed to detect any poultry-sourced pathogens with any frequency or at any significant levels; (4) assumes the presence of poultry-sourced pathogens, DBP precursors, and cyanobacteria despite the absence of evidence to support these conclusions; (5) offends the standard methodologies of toxicology and risk assessment; and (6) fails to distinguish environmental conditions in the IRW from several other watersheds throughout the State. Consequently, for the reasons stated herein, Defendants respectfully request that the Court enter an order:

- a. excluding Dr. Teaf's testimony on the alleged risks to human health in the IRW in its entirety, or in the alternative;
- b. excluding the portions of Dr. Teaf's testimony relating to alleged risks to human health in the IRW the court finds lacking in reliability and/or relevance as required by *Daubert*.

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I hereby certify that on this 18th day of May, 2009, I electronically transmitted the foregoing document to the Clerk of the Court using the ECF System for filing and transmittal of a Notice of Electronic Filing to the following ECF registrants:

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